Engineering

RAPID PROTOTYPING THE INTERVERTEBRAL DISC USING STRUCTURAL ANALYSIS

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Abstract

The ability to model mechanical properties of complex structures could have many important implications. Specifically in the medical field where tissues display complex properties, simple and accurate models could assist in biomedical product testing and research. An intervertebral disc (IVD) is located between every two vertebra of the spine and acts as a shock absorber for the body. No physical current models exist that accurately model the IVD's non-homogenous mechanical properties. This research proposes a method of modeling the IVD using rapid prototyping. By combining structural analysis and the mechanical properties of rapid prototyping materials, complex internal geometries can be formed such that the resultant model of the IVD will have the same structural response as the actual IVD. Rapid prototyping provides the ability to precisely place these complex geometries and patterns. The resulting rapid-prototyped model of the IVD could be an invaluable model in biomedical testing and research of the spine. It has been demonstrated that by using the relationship between structural response, cross-sectional area, and modulus of elasticity along with the capabilities of rapid prototyping, it is possible to create a physical model that exhibits the same complex mechanical properties as the human IVD.